

The Claims Defining the Invention are:

1. A padlock, including a shackle having a short leg with a first locking recess and a longer leg having an opposed second locking recess, said longer leg being connected by a longitudinally elongated recess or flat to a peripheral recess disposed towards the end of the longer leg,
 - and a casing having a short and a longer recess extending into the casing from a first end surface to accept the short and longer shackle leg respectively, a central recess extending into the casing from an opposed second end surface, an offset recess extending into the casing from the opposed second end surface and intersecting the central recess, the intersection defining a first and a second longitudinally elongated cusp portions, said short, longer and central recesses being intersected by a transverse recess extending into the casing from a first side of the casing,
 - a cylinder having a key operable barrel characterized by an undisplaced position enabling key removal,
 - two opposed balls supported within the transverse recess; a first ball able to protrude into the short recess and first locking recess and a second ball to protrude into the longer recess and second locking recess,
 - a cam to control the balls, and a coupler to facilitate operable coupling between the cam and the cylinder,
 - the coupler being mountable within the body to provide a Type 1 padlock characterized by an unlocked, open configuration where short leg is free of the casing, the longer leg is supported in the casing and the key is removable,
 - the coupler being mountable within the body to provide a Type 2 padlock characterized by an unlocked, open configuration where the short leg is free of the body, the longer leg is supported in the body casing and the key and barrel cannot be rotated to the undisplaced position to enable key removal.
2. A padlock, including a shackle having a short leg with a first locking recess and a longer leg having an opposed second locking recess, said longer leg being connected by a longitudinally elongated recess or flat to a peripheral recess disposed towards the end of the longer leg,
 - and a casing having a short and a longer recess extending into the casing from a first end surface to accept the short and longer shackle leg respectively, a central recess extending into the casing from an opposed second end surface, an offset recess extending into the casing from the opposed second end surface and intersecting the central recess, the intersection defining a first and a second vertically

longitudinal axis coaxial with the cam axis of rotation and which is parallel with and between the longitudinal axis of the short and longer recess in the casing,

said cam in a locking configuration presenting the curved surface to each ball to retain the balls in the locking recesses,

- 5 said cam in the unlocking configuration presenting a longitudinally elongated, side, first unlocking recess to the first ball and a longitudinally elongated, side, second unlocking recess to the second ball to enable the first ball to be removed from the first locking recess and the second ball to be partly removed from the second locking recess and be retained partly within the longitudinally elongated
10 recess or the flat or partly within the peripheral recess.

5. A padlock according to Claim 3 or 4, wherein the first cam portion is integrally connected to a cam drive portion relatively disposed towards the casing second end surface, said drive portion comprising two opposed drive recesses having coplanar
15 floors wherein the plane is orthogonal to the axis of rotation of the cam, said drive recesses being on opposite sides of the cam axis of rotation and being defined by an axial between bridge comprising opposed walls, each wall having a first engageable drive shoulder at one end and a second engageable shoulder at the other end, said bridge having opposed part cylindrical portions to support the disc-like member which
20 has an aperture of substantially circular cross-section interrupted by at least one inwardly protruding finger engageable with the first drive shoulder, wherein each finger abuts the first drive shoulder when the cam is in the locked and unlocked configurations.

- 25 6. A padlock according to Claim 3 or 4, configured as a Type 1 padlock, including at least one drive pin supported within the cylinder barrel to extend into the space between the at least one finger and second drive shoulder to be engageable with the at least one finger, to enable the pin to be displaced about the cylinder barrel axis of rotation to displace the first drive shoulder and the interposed finger to the
30 unlocking configuration, and the barrel and key to subsequently be returned to the undisplaced position while the drive pin correspondingly displaces freely within the space between the at least one finger and second drive shoulder.

7. A padlock according to Claim 3 or 4, configured as a Type 2 padlock,
35 including at least one drive pin supported within the cylinder barrel to extend through the space between the at least one finger and second drive shoulder to protrude into a pin recess within the floor of the drive recess and adjacent the finger, to enable the

pin to be displaced about the cylinder barrel axis of rotation to displace the first drive shoulder and the interposed finger to the unlocking configuration, the barrel and key being unable to be returned to the undisplaced position because of the direct coupling between the drive pin and cam.

8. A padlock according to Claim 6, wherein there is an opposed pair of fingers, an opposed pair of drive shoulders, opposed drive recesses with pin holes and there is correspondingly an opposed pair of drive pins,

said drive pins having passage through while being supported in a support disc to comprise a coupler, the drive pins being configured to protrude more from one side of the disc than the other and additionally being configured so that when assembled into the padlock body with the longer ends towards the cam, they protrude into the pin holes, and when assembled into the padlock body with the shorter ends towards the cam, they protrude into drive recesses but not into the pin holes.

9. A padlock according to Claim 7, wherein there is an opposed pair of fingers, an opposed pair of drive shoulders, opposed drive recesses with pin holes and there is correspondingly an opposed pair of drive pins,

said drive pins having passage through while being supported in a support disc to comprise a coupler, the drive pins being configured to protrude more from one side of the disc than the other and additionally being configured so that when assembled into the padlock body with the longer ends towards the cam, they protrude into the pin holes, and when assembled into the padlock body with the shorter ends towards the cam, they protrude into drive recesses but not into the pin holes.

10. A padlock according to Claim 5, wherein the first cam portion has a removal configuration enabling the removal of the shackle, the cam in the removal configuration presenting a longitudinally elongated, side, third recess, deeper than the second recess, to the second ball to enable the second ball to be removed from all the recesses of the longer leg,

and wherein the cam is rotatable in the unlocking direction to the removal configuration while the stop remains in the second operative configuration,

11. A padlock according to Claim 10, wherein each finger in the removal configuration of the cam abuts an associated second drive shoulder.
12. A padlock according to Claim 5, including a torsion spring supported about the bridge having one end attached to the cam and the other within the offset recess to bias the cam towards the locking configuration
13. A padlock according to any one of Claims 1 to 4, including a compression spring within the longer recess to bias the shackle from the body.
14. A padlock according to any one of Claims 1 to 4, wherein the cylinder is removable to provide accessibility to the cam to enable it to be rotated to the removal configuration while the stop remains undisplaced in the second operative position.
15. A padlock according to any one of Claims 1 to 4, wherein the cylinder is retained in the casing by a threaded fastener having a head accessible through the short recess, said cylinder barrel being free to rotate without limitation when the cylinder is removed from the casing.
16. A padlock according to any one of Claims 1 to 4, wherein the cylinder comprises an interchangeable core retained in the casing by a sideways protruding shoulder that is displaceable to withdraw into the core by the application of a control key, said cylinder barrel being free to rotate without limitation when the cylinder is removed from the casing.
17. A padlock according to any one of Claims 1 to 4, wherein the cylinder comprising a pin cylinder having a casing with pin chambers extending from the surface of the casing, and wherein adjacent chambers adjacent the surface of the casing are joined by a channel, said channel accommodating a resilient elongated strip extending between the chambers and having substantially cylindrical portions extending one into each chamber.
18. A padlock according to any one of claims 1 to 4 and substantially as described herein with reference to and as illustrated in the accompanying drawings.

19. A padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis.

20. A padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, including a locking recess comprising two such portions located adjacently and a small distance from an other recess each being joined by a channel portion.

21. A padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, wherein the padlock shackle is defined by two parallel co-planar legs; a short leg having a first locking recess and a longer leg having a second locking, substantially opposed, recess; the second locking recess being connected by a longitudinally elongated recess to a peripheral recess disposed towards the end of the longer leg, the surface of the first and second locking recesses being substantially comprised of a portion or portions of surfaces of revolution, each said portion having an axis of revolution which intersects the shackle body to provide a surface portion extending on all sides from the axis of revolution.

22. A padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, including a locking recess comprising two such portions located adjacently and a small distance from an other recess each being joined by a channel portion, wherein the padlock shackle is defined by two parallel co-planar legs; a short leg having a first locking recess and a longer leg having a second locking, substantially opposed, recess; the second locking recess being connected by a longitudinally elongated recess to a peripheral recess disposed towards the end of the longer leg,

the surface of the first and second locking recesses being substantially comprised of a portion or portions of surfaces of revolution, each said portion having an axis of revolution which intersects the shackle body to provide a surface portion extending on all sides from the axis of revolution.

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23. A padlock shackle according to Claim 21 or 22, wherein the longitudinally elongated recess comprises a longitudinal channel

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24. A padlock shackle according to Claim 21 or 22, wherein the peripheral recess comprises a peripheral channel around the periphery of the shackle body

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25. A padlock shackle according to any one of Claims 19 to 22, wherein the portions of surfaces of revolution and comprise spherical portions defined by a radius substantially the same as the radii of the balls.

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26. A padlock shackle according to Claim 23, wherein the channel cross-section is defined by a radius substantially the same as the radii of the balls.

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27. A padlock shackle according to Claim 24, wherein the channel cross-section is defined by a radius substantially the same as the radii of the balls.

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28. A padlock shackle according to any one of claims 19 to 22 and substantially as described herein with reference to and as illustrated in the accompanying drawings.

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29. A padlock according to any one of claims 1 to 4 which includes a shackle selected from the group consisting of:

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(i) a padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis;

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(ii) a padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, including a locking recess comprising two such portions located adjacently

and a small distance from an other recess each being joined by a channel portion;

(iii) a padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, wherein the padlock shackle is defined by two parallel co-planar legs; a short leg having a first locking recess and a longer leg having a second locking, substantially opposed, recess; the second locking recess being connected by a longitudinally elongated recess to a peripheral recess disposed towards the end of the longer leg, the surface of the first and second locking recesses being substantially comprised of a portion or portions of surfaces of revolution, each said portion having an axis of revolution which intersects the shackle body to provide a surface portion extending on all sides from the axis of revolution; and

(iv) a padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, including a locking recess comprising two such portions located adjacently and a small distance from an other recess each being joined by a channel portion, wherein the padlock shackle is defined by two parallel co-planar legs; a short leg having a first locking recess and a longer leg having a second locking, substantially opposed, recess; the second locking recess being connected by a longitudinally elongated recess to a peripheral recess disposed towards the end of the longer leg, the surface of the first and second locking recesses being substantially comprised of a portion or portions of surfaces of revolution, each said portion having an axis of revolution which intersects the shackle body to provide a surface portion extending on all sides from the axis of revolution.

30. A method of manufacture of a padlock shackle according to any one of Claims 19 to 22, including the step of advancing a rotating cutter blade into the side of an unformed shackle blank to manufacture a recess.

31. A method of manufacture of a padlock shackle according to any one of Claims 19 to 22, including the steps of;

(1) advancing a rotating cutter blade into the side of an unformed shackle blank to manufacture a recess, and

enable the second ball to be removed from all the recesses of the longer leg, wherein each finger in the removal configuration of the cam abuts an associated second drive shoulder.

- and wherein the cam is rotatable in the unlocking direction to the removal
 5 configuration while the stop remains in the second operative configuration,
 said removal configuration corresponding to the short leg being free of the casing.
 said cam in a locking configuration presenting the curved surface to each ball
 to retain the balls in the locking recesses,
 10 said cam in the unlocking configuration presenting a longitudinally elongated,
 side, first unlocking recess to the first ball and a longitudinally elongated, side,
 second unlocking recess to the second ball to enable the first ball to be removed
 from the first locking recess and the second ball to be partly removed from the
 second locking recess and be retained partly within the longitudinally elongated
 15 recess or the flat or partly within the peripheral recess.

38. A padlock, including a shackle as claimed in any one of claims 19 to 28
 having a short leg with a first locking recess and a longer leg having an opposed
 second locking recess, said longer leg being connected by a longitudinally elongated
 20 recess or flat to a peripheral recess disposed towards the end of the longer leg,
 and a casing having a short and a longer recess extending into the casing
 from a first end surface to accept the short and longer shackle leg respectively, a
 central recess extending into the casing from an opposed second end surface, an
 offset recess extending into the casing from the opposed second end surface and
 25 intersecting the central recess, the intersection defining a first and a second vertically
 longitudinally elongated cusp portion, said short, longer and central recesses being
 intersected by a transverse recess extending into the casing from a first side of the
 casing,
 a cylinder having a key operable barrel characterized by an undisplaced
 30 position enabling key removal,
 two opposed balls supported within the transverse recess; a first ball able to
 protrude into the short recess and first locking recess and a second ball to protrude
 into the longer recess and second locking recess
 a cam to control the balls,
 35 the angular disposition of the cam in the locking and unlocking configurations
 being determined by a stop comprising a disc-like member supported coaxially with
 and relative to the cam, and being angularly displaceable relative to the cam, and

second locking recess and be retained partly within the longitudinally elongated recess or the flat or partly within the peripheral recess.

39. A padlock, including a shackle having a short leg with a first locking recess
 5 and a longer leg having an opposed second locking recess, said longer leg being connected by a longitudinally elongated recess or flat to a peripheral recess disposed towards the end of the longer leg, the shackle also having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where
 10 the surface of the recess extends in all directions from the axis,

and a casing having a short and a longer recess extending into the casing from a first end surface to accept the short and longer shackle leg respectively, a central recess extending into the casing from an opposed second end surface, an offset recess extending into the casing from the opposed second end surface and
 15 intersecting the central recess, the intersection defining a first and a second longitudinally elongated cusp portions, said short, longer and central recesses being intersected by a transverse recess extending into the casing from a first side of the casing,

a cylinder having a key operable barrel characterized by an undisplaced
 20 position enabling key removal,

two opposed balls supported within the transverse recess; a first ball able to protrude into the short recess and first locking recess and a second ball to protrude into the longer recess and second locking recess,

a cam to control the balls, and a coupler to facilitate operable coupling
 25 between the cam and the cylinder,

the coupler being mountable within the body to provide a Type 1 padlock characterized by an unlocked, open configuration where short leg is free of the casing, the longer leg is supported in the casing and the key is removable,

the coupler being mountable within the body to provide a Type 2 padlock
 30 characterized by an unlocked, open configuration where the short leg is free of the body, the longer leg is supported in the body casing and the key and barrel cannot be rotated to the undisplaced position to enable key removal,

wherein the cam includes a first cam portion comprising a substantially cylindrical portion defined by a peripheral, side, curved surface and having a
 35 longitudinal axis coaxial with the cam axis of rotation and which is parallel with and between the longitudinal axii of the short and longer recess in the casing, and

wherein the first cam portion is integrally connected to a cam drive portion relatively disposed towards the casing second end surface,

and wherein said drive portion comprising two opposed drive recesses having coplanar floors wherein the plane is orthogonal to the axis of rotation of the cam, said drive recesses being on opposite sides of the cam axis of rotation and being defined by an axial between bridge comprising opposed walls, each wall having a first engageable drive shoulder at one end and a second engageable shoulder at the other end, said bridge having opposed part cylindrical portions to support the disc-like member which has an aperture of substantially circular cross-section interrupted by at least one inwardly protruding finger engageable with the first drive shoulder, wherein each finger abuts the first drive shoulder when the cam is in the locked and unlocked configurations,

said cam in a locking configuration presenting the curved surface to each ball to retain the balls in the locking recesses,

said cam in the unlocking configuration presenting a longitudinally elongated, side, first unlocking recess to the first ball and a longitudinally elongated, side, second unlocking recess to the second ball to enable the first ball to be removed from the first locking recess and the second ball to be partly removed from the second locking recess and be retained partly within the longitudinally elongated recess or the flat or partly within the peripheral recess,

wherein the first cam portion has a removal configuration enabling the removal of the shackle, the cam in the removal configuration presenting a longitudinally elongated, side, third recess, deeper than the second recess, to the second ball to enable the second ball to be removed from all the recesses of the longer leg,

and wherein the cam is rotatable in the unlocking direction to the removal configuration while the stop remains in the second operative configuration,

said removal configuration corresponding to the short leg being free of the casing.

40. A padlock, including a shackle having a short leg with a first locking recess and a longer leg having an opposed second locking recess, said longer leg being connected by a longitudinally elongated recess or flat to a peripheral recess disposed towards the end of the longer leg, the shackle also having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis,

between the longitudinal axis of the short and longer recess in the casing, and wherein the first cam portion has a removal configuration enabling the removal of the shackle,

5 said cam in a locking configuration presenting the curved surface to each ball to retain the balls in the locking recesses,

said cam in the unlocking configuration presenting a longitudinally elongated, side, first unlocking recess to the first ball and a longitudinally elongated, side, second unlocking recess to the second ball to enable the first ball to be removed from the first locking recess and the second ball to be partly removed from the
10 second locking recess and be retained partly within the longitudinally elongated recess or the flat or partly within the peripheral recess.

and wherein the cam in the removal configuration presents a longitudinally elongated, side, third recess, deeper than the second recess, to the second ball to enable the second ball to be removed from all the recesses of the longer leg,

15 and wherein the cam is rotatable in the unlocking direction to the removal configuration while the stop remains in the second operative configuration,

said removal configuration corresponding to the short leg being free of the casing.

20 41. A padlock shackle having at least one locking recess having a surface comprising a portion or portions of surfaces of revolution in which the axis of revolution defining the surface intersects the body of the leg and where the surface of the recess extends in all directions from the axis, including a locking recess comprising two such portions located adjacently and a small distance from an other
25 recess each being joined by a channel portion, wherein the padlock shackle is defined by two parallel co-planar legs; a short leg having a first locking recess and a longer leg having a second locking, substantially opposed, recess; the second locking recess being connected by a longitudinally elongated channel to a peripheral channel around the periphery of the shackle body, disposed towards the end of the
30 longer leg, the channel cross-section being defined by a radius substantially the same as the radii of the balls

the surface of the first and second locking recesses being substantially comprised of a portion or portions of surfaces of revolution, each said portion having an axis of revolution which intersects the shackle body to provide a surface portion
35 extending on all sides from the axis of revolution,

wherein the portions of surfaces of revolution comprise spherical portions defined by a radius substantially the same as the radii of the balls.